# Signal Sources

## CATALOG




KEYSIGHT

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# Keysight Signal Generators

## One family. Three performance grades. 6 classes.

### Vector Signal Generators



**ESSENTIAL**

**XG1, XG2-class**

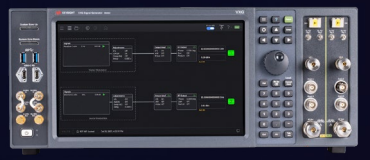
- 6 GHz to 40 GHz Maximum frequency
- 120 MHz to 160 MHz Maximum modulation bandwidth



**EXPERT**

**XG4, XG5-class**

- 8.5 GHz to 40 GHz Maximum frequency
- 400 MHz to 1 GHz Maximum modulation bandwidth



**PRO**

**XG7-class**

- 54 GHz Maximum frequency
- 2.5 GHZ Maximum modulation bandwidth

### Analog Signal Generators



**ESSENTIAL**

**XG1, XG2-class**

- 6 GHz to 40 GHz Maximum frequency
- 1 to 4 Outputs



**EXPERT**

**XG5, XG6-class**

- 8.5 GHz to 54 GHz Maximum frequency
- 1 to 4 Outputs



**PRO**

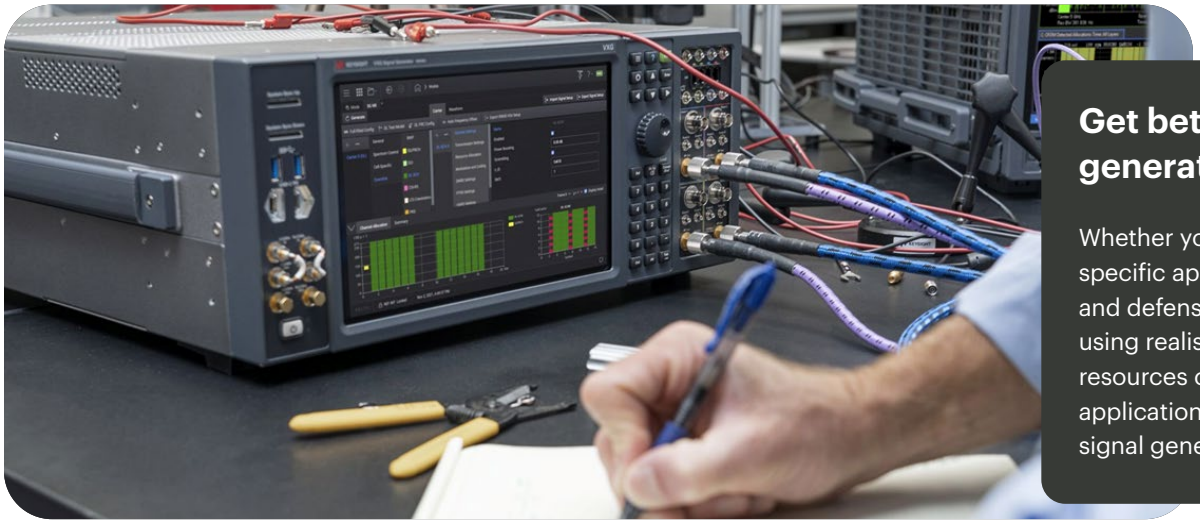
**XG7-class**

- 67 GHz Maximum frequency
- 1 to 2 Outputs

# Introduction

## Keysight Signal Generators — from research to manufacturing testing

Keysight signal generators are offered in six capability classes across three performance grades: Essential, Expert, and Pro. Within vector signal generators, Essential includes the XG1- and XG2-classes for affordable, entry-level signal generation. Expert includes the XG4- and XG5-classes, with modulation bandwidths up to 1 GHz. Pro includes the XG7-class, with maximum frequencies up to 54 GHz. Within analog signal generators, Essential includes the XG1- and XG2-classes. Expert includes the XG5- and XG6-classes, with increased maximum frequency and harmonic performance. Pro includes the XG7-class, with maximum frequencies up to 67 GHz. A comprehensive library of signal generator resources is available to help you find the performance grade and class best suited to your lab.

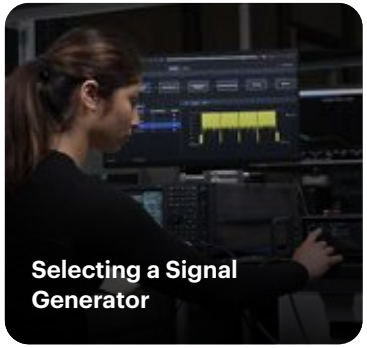


### Get better insights with realistic signal generation

Whether you are working on general-purpose or industry-specific applications such as 5G, automotive, or aerospace and defense, you need to stimulate your device under test using realistic signals with the highest signal integrity. Keysight resources cover everything from fundamentals to complex applications to help you develop a deeper understanding of signal generators.

Here are a few examples of the resources you will find to help you select the signal generator that is right for you:






# Vector Signal Generators

Keysight vector signal generators enable you to stimulate your device or system under test using complex, digitally modulated, realistic signals with high signal integrity. When paired with our signal generation software, you can perform rapid, accurate tests with predefined, standards-based waveforms for cellular communications like 5G New Radio (NR), wireless connectivity like wireless local area network (WLAN) 802.11, and navigation solutions like global navigation satellite systems (GNSS). Select the signal generator performance you need based on maximum frequency, bandwidth, and channels, as well as phase noise. Explore our range of models from Essential to Pro performance grades to find the one that is right for your application.







| | Essential<br>**XG1, XG2-class** | Expert<br>**XG4, XG5-class** | Pro<br>**XG7-class** |
|---|---|---|---|
| Maximum frequency | **6 GHz** | **8.5 GHz to 40 GHz** | **54 GHz** |
| Maximum modulation bandwidth | **120 MHz to 160 MHz** | **400 MHz to 1 GHz** | **2.5 GHz** |
| Number of outputs | **1** | **1 to 4** | **1 to 4** |
| Phase noise @ 1 GHz (20 kHz offset) | **-122 dBc/Hz to -119 dBc/Hz** | **-147 dBc/Hz to -145 dBc/Hz** | **-148 dBc/Hz** |
| Output power @ 1 GHz | **18 dBm to 21 dBm** | **18 dBm to 25 dBm** | **20 dBm** |
| Harmonics @ 1 GHz | **-35 dBc** | **-45 dBc to -35 dBc** | **-55 dBc** |
| Frequency switching speed | **800 µs to 5000 µs** | **2 µs to 800 µs** | **3 ms** |
| Brands included | **CXG and EXG Series** | **AP5041A-AP5042A and MXG Series** | **VXG and VXG-m Series** |
| | Explore | Explore | Explore |

# Essential Vector Signal Generators

## Fundamental signal generation for general-purpose applications

Keysight Essential vector signal generators come in two classes. The XG1-class includes the CXG Series and the XG2-class includes the EXG Series. They are used in a variety of applications, including wireless communications for testing 5G devices (sub-6 GHz FR1), Wi-Fi®, and *Bluetooth*® systems. They are also critical in RF testing for evaluating radar systems, antenna performance, and signal integrity in general electronics. Far from basic, these entry-level vector signal generators also offer enhanced features such as additive white Gaussian noise (AWGN) to simulate real-world conditions and multitone generation capabilities to minimize distortion. Request a quote or order an Essential vector signal generator today.

**Learn more about our Essential vector signal generators**

### Preconfigured waveforms

Test your devices with multiple, verified, standards-compliant vector signals, including 5G NR FR1, WLAN 802.11, and ZigBee®, using high-fidelity signal generation.

### Generate multitone signals

Generate interference in transmissions or neighboring channels. Characterize nonlinear devices like amplifiers and mixers by simulating the intermodulation distortion.

### Simulate real-world conditions

Add AWGN to a carrier in real-time with an available calibrated noise generator to evaluate receiver sensitivity and simulate real-world conditions.

### Self-maintenance capabilities

Quickly identify and address instrument issues, ensuring minimal disruption to testing. Internal self-diagnostics ensure your signal generator remains in optimal working condition.

| Class | Included Brands | Range of Performance Specifications | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Maximum Frequency | Maximum Modulation Bandwidth | Number of Outputs | Phase Noise @1 GHz (20 kHz offset) | Output Power @1 GHz | Harmonics @1 GHz | Frequency Switching Speed |
| XG1 | CXG Series | 6 GHz | 120 MHz | 1 | -119 dBc/Hz | +18 dBm | -35 dBc | 5 ms |
| XG2 | EXG Series | 6 GHz | 160 MHz | 1 | -122 dBc/Hz | +21 dBm | -35 dBc | 800 µs |

Buy / Get quote

# Expert Vector Signal Generators

## High-performance bandwidth and precision

Keysight Expert vector signal generators come in two classes. The XG4-class includes the AP5041A-AP5042A and the XG5-class includes the N5186A MXG. Our Expert models build upon the capabilities of our Essential models with wider bandwidths and enhanced spectral purity, as well as cutting-edge capabilities like direct digital synthesis (DDS), an embedded reflectometer (XG5-class), and up to four phase-coherent outputs for complex testing like multiple-input / multiple-output (MIMO) and beamforming. DDS enables fast frequency switching and reduces phase noise and distortion. The embedded reflectometer characterizes the device under test (DUT) match with a single button to generate a match-corrected signal at the reference plane for reduced measurement uncertainty. Expert vector signal generators feature software to create complex modulations like 5G NR and multi-tone signals. Request a quote for an Expert vector signal generator today.

**Learn more about our Expert vector signal generators**

### Complex wideband signals

Generate complex wideband signals needed for carrier aggregation and digital pre-distortion (DPD) applications with up to 1 GHz bandwidth per channel.

### Spectrally efficient signals

Ensure repeatable, high-quality measurements to speed up R&D testing or optimize production test margins with low adjacent channel power ratio (ACPR) and high output power.

### Fast switching speeds

Accelerate testing or emulate fast moving signals like radar with rapid switching speeds and list mode preprogramming of frequency, amplitude, and other parameters.

### Ultra-low phase noise

Critical for capturing precise measurements in highly sensitive applications like radar, satellite communications, and high-frequency oscillators.

| Class | Included Brands | Range of Performance Specifications | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Maximum Frequency | Maximum Modulation Bandwidth | Number of Outputs | Phase Noise @1 GHz (20 kHz offset) | Output Power @1 GHz | Harmonics @1 GHz | Frequency Switching Speed |
| XG4 | AP5041A, AP5042A | 40 GHz | 400 MHz | 1 to 4 | -145 dBc/Hz | +18 dBm | -45 dBc | 2 µs |
| XG5 | MXG Series | 8.5 GHz | 1 GHz | 4 | -147 dBc/Hz | +25 dBm | -35 dBc | 800 µs |

Get quote

# Pro Vector Signal Generators

## Generate the most complex wideband signals

Keysight XG7-class Pro vector signal generators include the VXG Series. Pro vector signal generators extend frequency support up to 54 GHz, or 110 GHz with a frequency extender, and bandwidth up to 2.5 GHz while supporting direct digital synthesis, embedded software, and other key features of our Expert models. Additional capabilities include channel bonding, providing up to 10 GHz bandwidth per instrument, real-time fading including custom fading models with signal generation software, and eight virtual signal generators per RF channel or 32 emulated transmitters in a single unit. Request a quote for a Pro vector signal generator today.

**Learn more about our Pro vector signal generators**

### Ultra-high frequency

Covers all 5G NR frequency bands and V- / W-bands up to 54 GHz, or 110 GHz with a frequency extender, with up to 2.5 GHz modulation bandwidth per channel.

### Emulate up to 32 signals

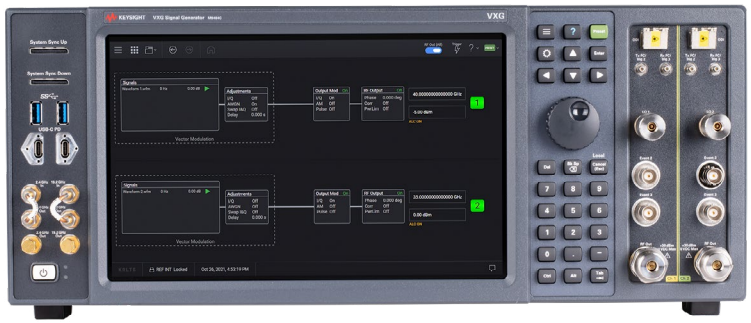
Simplifies MIMO and beamforming tests with up to 4 synchronized and phase-coherent channels in one instrument, plus eight virtual emulators per channel with high dynamic range.

### Real-time application support

Real-time signal creation for 5G and LTE uplink and GNSS, plus MIMO real-time fading for all 3GPP 5G NR base station conformance testing.

### Lowest phase noise

Proprietary custom ASICs and DDS technology provide the lowest phase noise, down to -148 dBc/Hz, with extremely fine frequency tuning resolution.



| | |
|---|---|
| Maximum frequency | **54 GHz** |
| Maximum modulation bandwidth | **2.5 GHz** |
| Number of outputs | **1 to 4** |
| Phase noise @ 1 GHz (20 kHz offset) | **-148 dBc/Hz** |
| Output power @ 1 GHz | **+20 dBm** |
| Harmonics @ 1 GHz | **-55 dBc** |
| Frequency switching speed | **3 ms** |

Get quote

# Analog Signal Generators

Keysight analog signal generators deliver low-phase-noise signals with precise frequency control, flexible configurations, and fast switching speeds. If you need more sophisticated modulation techniques, refer to our vector signal generators. Select the analog signal generator performance level you need based on frequency, max channels, phase noise, and output power. Explore our wide range of models from Essential to Pro performance levels to find the one that is right for your application.







| | Essential<br>**XG1, XG2-class** | Expert<br>**XG5, XG6-class** | Pro<br>**XG7-class** |
|---|---|---|---|
| Maximum frequency | **6 GHz to 40 GHz** | **8.5 GHz to 54 GHz** | **67 GHz** |
| Number of outputs | **1 to 4** | **1 to 4** | **1 to 2** |
| Phase noise @ 1 GHz (20 kHz offset) | **-122 dBc/Hz to -130 dBc/Hz** | **-146 dBc/Hz to -150 dBc/Hz** | **-143 dBc/Hz to -153 dBc/Hz** |
| Output power @ 1 GHz | **+17 dBm to +25 dBm** | **+17 dBm to +25 dBm** | **+21 dBm** |
| Harmonics @ 1 GHz | **-33 dBc to -40 dBc** | **-33 dBc to -60 dBc** | **-55 dBc** |
| Frequency switching speed | **800 µs to 20 µs** | **800 µs to 3 µs** | **11 ms to 7 ms** |
| Brands included | **AP5001A-AP5012A**<br>**N5171B**<br>**N5173B** | **N5185A**<br>**N5181B-N5183B**<br>**AP5021A-AP5032A** | **SG6311A**<br>**E8257D**<br>**E8663D** |
| | Explore | Explore | Explore |

# Essential Analog Signal Generators

## General-purpose signal generation

Keysight Essential analog signal generators come in two classes. The XG1-class includes the AP5001A, AP5002A and the XG2-class includes the AP5011A, AP5012A N5171B, and N5173B. Essential analog signal generators feature low phase noise, a wide output power range, and fast switching speeds needed to test a variety of devices and communication systems. Additionally, our Essential models are available in four phase-coherent output configurations with a 40 GHz max frequency, ideal for evaluating the signal strength, frequency response, or noise performance in multiport receiver testing. Choose one of our popular configurations or configure one specific to your application.

**Learn more about our Essential analog signal generators**

### Low phase noise

Provides a clean, stable signal ideal for testing high-precision components like oscillators, mixers, and amplifiers in applications including 5G, Wi-Fi, and general wireless applications.

### High output power

Compensate for system loss, enhance SNR, and test components from short-range wireless systems to long-distance communication links with greater than +17 dBm output power.

### Fast switching speed

Simulate real-world signal transitions with rapid switching speeds, ideal for testing pulse and burst signals like radar or nonlinear devices like power amplifiers.

### Modulation capabilities

Leverage modulation capabilities such as AM, FM, PM, and pulse modulation to generate complex analog waveforms for thorough testing of RF receivers, components, and systems.

| Class | Included Brands | Range of Performance Specifications | | | | | |
|---|---|---|---|---|---|---|---|
| | | Maximum Frequency | Number of Outputs | Phase Noise @1 GHz (20 kHz offset) | Output Power @1 GHz | Harmonics @1 GHz | Frequency Switching Speed |
| XG1 | AP5001A, AP5002A | 6.1 GHz to 26 GHz | 1 | -130 dBc/Hz | +17 dBm to +23 dBm | -40 dBc | 20 µs to 200 µs |
| XG2 | AP5011A, AP5012A, N5171B, N5173B | 6 GHz to 40 GHz | 1 to 4 | -130 dBc/Hz to -122 dBc/Hz | +21 dBm to +25 dBm | -40 dBc to -33 dBc | 25 µs to 800 µs |

**View popular configurations**

# Expert Analog Signal Generators

## Pure and precise signal generation

Keysight Expert analog signal generators come in two classes. The XG5-class includes the N5185A, N5181B, and N5183B MXG, and the AP5021A and AP5022A compact signal generators. The XG6-class includes the AP5031A and AP5032A compact signal generators. Expert analog signal generators build upon the capabilities of our Essential models to support a wider max frequency range and lower phase noise. Compact Expert models support a max frequency up to 54 GHz and ultra-fast switching speeds as low as 3 microseconds. Expert models are available in multichannel configurations and offer enhanced features like DDS to generate precise, low-distortion signals and an embedded reflectometer to automate DUT match correction. Choose one of our popular configurations or configure one specific to your application.

**Learn more about our Expert analog signal generators**

### Ultra-low phase noise

Ensure the signal stability and purity required for demanding radar, analog-to-digital converter (ADC), and receiver-blocking tests with ultra-low phase noise.

### Low harmonic distortion

Pure signal generation with low harmonic distortion reduces interference, improving signal integrity, and enabling more accurate RF measurements.

### Ultra-fast switching speed

Achieve more accurate and dynamic signal simulation with switching speeds ranging from 800 µs to 3 µs, enabling precise replication of real-world RF environments.

### Flexible configurations

Choose the right number of channels for your application, from a compact, single-channel model to a multichannel unit ideal for multiport receiver testing.

| Class | Included Brands | Range of Performance Specifications | | | | | |
|---|---|---|---|---|---|---|---|
| | | Maximum Frequency | Number of Outputs | Phase Noise @1 GHz (20 kHz offset) | Output Power @1 GHz | Harmonics @1 GHz | Frequency Switching Speed |
| XG5 | N5185A, N5183B, AP5021A, AP5022A | 8.5 GHz to 54 GHz | 1 to 4 | -146 dBc/Hz to -145 dBc/Hz | +17 dBm to +25 dBm | -55 dBc to -33 dBc | 15 µs to 800 µs |
| XG6 | AP5031A, AP5032A | 51 GHz | 1 to 4 | -150 dBc/Hz | +18 dBm | -60 dBc | 3 µs |

**View popular configurations**

# Pro Analog Signal Generators

## Metrology-grade performance for demanding applications

Keysight XG7-class Pro analog signal generators include the SG6311A, E8257D, and E8663D PSG signal generators. They offer metrology-grade signal purity, frequency coverage up to 67 GHz (extendable to 1.1 THz), and up to two RF channels for testing critical applications in calibration labs, research environments, and production testing. You can rely on the highest-quality signals, from pure continuous wave (CW) tones to complex analog modulated signals with up to 1 W of power with a high-power extension. Request a quote or order a Pro analog signal generator today.

**Learn more about our Pro analog signal generators**

### Spectral purity

Low phase noise, broadband noise, harmonics, and spurious signals ensure accurate testing of RF integrated circuits (RFICs), communication receivers, and other high-precision applications.

### High max frequency

Offers max frequency of 67 GHz, and up to 1.1 THz with a frequency extender, enabling 6G research and development (R&D) and very high-frequency radar and satellite communication testing.

### Metrology-grade signals

Traceable to national and international standards, ensuring accurate, repeatable results with minimal errors, ideal for precision signal generation in R&D, military testing, and satellite communications.

### Ultra-high output power

Test high-power devices and overcome test system losses with optional high-power extension, which increases the maximum output power to +30 dBm (1 W), reducing the need for external amplification.

| | |
|---|---|
| Maximum frequency | **67 GHz** |
| Number of outputs | **1 to 2** |
| Phase noise @ 1 GHz (20 kHz offset) | **-143 dBc/Hz to -153 dBc/Hz** |
| Output power @ 1 GHz | **+21 dBm** |
| Harmonics @ 1 GHz | **-55 dBc** |
| Frequency switching speed | **11 ms to 7 ms** |

**Buy / Get quote**

# Agile Signal Generators

## Accurately simulate complex signal scenarios

Keysight XG9-class agile signal generators include the UXG models. They simulate complex signal environments with an arbitrary waveform generator for testing specific protocols or unique communication formats for radar, electromagnetic spectrum operations (EMSO), and antenna testing. Its rapid frequency, amplitude, and phase-switching capabilities allow for accurate emulation of multi-threat scenarios. Choose one of our popular configurations or configure one specific to your application.

Learn more about our agile signal generators

### Ultra-fast switching speed

Generate complex, dynamic signals in real-time with agile switching of frequency, phase, and amplitude with continuity and repeatability.

### Pulse capabilities

Enhanced pulse modulation, including chirp, pulsed, and frequency modulated continuous wave (FMCW) radar signals, with varying pulse widths, frequency modulations, and timings.

### Scalable, multi-emitter test

Emulate complex, crowded threat environments by scaling up the number of units to create thousands of radar threat-emitters and millions of pulses per second with unique antenna scans.

### Baseband vector generator

Simulate complex electromagnetic environments across the full frequency range by adding an optional 1.6 GHz bandwidth baseband vector generator.

| Class | Included Brands | Range of Performance Specifications | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Maximum Frequency | Maximum Modulation Bandwidth | Number of Outputs | Phase Noise @1 GHz (20 kHz offset) | Output Power @1 GHz | Harmonics @1 GHz | Frequency Switching Speed |
| XG9 | N5193A, N5194A | 40 GHz | 1.6 GHz | 1 | –144 dBc/Hz | 3 dBm to 10 dBm | < -60 dBc to < -50 dBc | 0.22 µs to 0.18 µs |

View popular configurations

# Frequency Synthesizers

## Compact, pure frequency synthesizers for RF testing

Keysight FS Frequency Synthesizers are the FS1- and FS2-classes, which include the AP4001-AP4022A Frequency Synthesizers. They provide frequency synthesizers provide fast switching speeds, low phase noise, and high signal quality for a wide range of signals with precise frequency control. With single-channel and multichannel options and a variety of form factors available, our frequency synthesizers offer a scaled-down, affordable, compact option when the higher-level modulation capabilities of a signal generator are not required. Their compact size allows you to easily integrate them into your test system for various applications, including wireless communications, radar, electronic warfare, and quantum computing. Select the frequency synthesizer performance level you need based on max frequency, number of phase-coherent channels, phase noise, and switching frequency.

**Learn more about our frequency synthesizers**

### Precision and accuracy

Deliver precise, stable signals quickly with ultra-fast switching and low-phase noise, ensuring high signal integrity in applications like wireless communication systems or high-frequency radar.

### Enhanced synchronization

Ensure exceptional frequency accuracy and stability with the internal oven-controlled crystal oscillator (OXCO), ideal for high-precision applications.

### Compact and easy to integrate

Support for various form factors, including compact and rack-mountable for space-constrained embedded systems, as well as portable benchtop models for R&D and field testing.

### Flexible configurations

Choose the right number of channels for your application, from cost-effective single-channel models to multichannel units ideal for MIMO applications or testing multiple frequency bands at once.

| Class | Included Brands | Range of Performance Specifications | | | | |
|---|---|---|---|---|---|---|
| | | Maximum Frequency | Number of Outputs | Phase Noise @1 GHz (20 kHz offset) | Frequency Switching Speed | Output Power @1 GHz |
| FS1 | AP4011A-AP4022A | 20 GHz to 40 GHz | 1 to 4 | -125 dBc/Hz to -147 dBc/Hz | 20 µs to 5 µs | +18 dBm to +20 dBm |
| FS2 | AP4003A-AP4007A | 20 GHz to 22 GHz | 1 to 4 | -131 dBc/Hz to -147 dBc/Hz | 15 µs to 5 µs | +15 dBm to +25 dBm |

**View popular configurations**

# Modular Signal Generators

## Compact multichannel signal generation

Keysight modular analog and vector signal generators are built for applications that require multichannel measurement capabilities, measurement speed, and a small footprint. They provide you with the scalability and flexibility needed to create test systems with a shared processor, chassis, and other modular instruments.

With models ranging from 6 GHz to 44 GHz with varying performance levels, select the modular signal generator that is right for your application.

**See catalog**

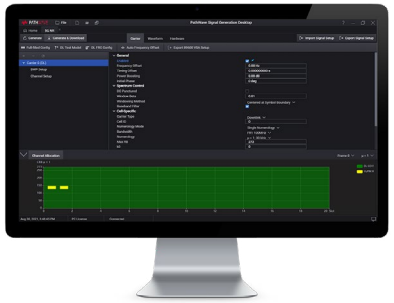



| | |
|---|---|
| Maximum frequency | **6 GHz to 44 GHz** |
| Maximum modulation bandwidth | **2 GHz** |
| Phase noise @ 1 GHz (20 kHz offset) | **-118 dBc/Hz to -137 dBc/Hz** |
| Output power @ 1 GHz | **+19 dBm to +20 dBm** |
| Harmonics @ 1 GHz | **-29 dBc to -46 dBc** |
| Frequency switching speed | **28 ms to 10 µs** |

# Software and Accessories

## Find compatible software and accessories for your signal generator

Keysight's signal generation software streamlines the creation of complex test signals for various applications, including cellular communications, wireless connectivity, aerospace and defense, navigation, broadcasting, and general-purpose testing. Available in both desktop and embedded versions, it offers a consistent user experience across platforms. Our signal generation software supports multiple radio formats, provides enhanced signal creation capabilities such as the ability to create custom, standards-based common test signals, and includes add-on features like real-time fading, IQ impairments, and AWGN for comprehensive transmitter, receiver, and component testing.



**Power your signal generator with a wide range of specialty software in the following categories:**

- cellular and automotive communications standards like 5G NR / 5G-Advanced, LTE-V2X, and NR-V2X
- wireless connectivity and Internet of Things (IoT) standards like *Bluetooth*®, WLAN 802.11 / Wi-Fi, and HRP UWB
- satellite, video, audio, and radio tests like satellite communication (DVB-S / S2 / S2X), broadcast radio, digital video, and land mobile radio
- detection, positioning, tracking, and navigation tests like GNSS, pulse building, and multi-emitter scenario generation (MESG)
- general-purpose and waveform tools: custom IQ, custom OFDM, multitone, and advanced waveform utility (AWU)

Explore software



**Get more functionality out of your signal generator by pairing it with the right accessories, including:**

- frequency extenders
- power sensors
- power meters
- cabling
- power splitter or divider
- calibration kit
- cooling spacer kit

Explore accessories

# Keysight Support Services

## Explore the services that are right for you

Keysight Support Services can reduce your learning curve, enhance your uptime, guarantee the accuracy of your testing equipment, and provide the expertise you require, precisely when and where you need it.

Maximize your instrument uptime, quickly optimize your test measurements, and get the answers you need at our fastest available times. KeysightCare curated support plans bundle critical services with prioritized response and turnaround times. **High-performance instruments include one year of KeysightCare Assured.**

**Explore support services**



### Calibration

Ensure your test system performs to specification and meets local and global standards.



### Repair

Restore equipment to original functionality and specifications with trained technicians.



### KeysightCare

Innovate at speed with curated support plans and prioritized response and turnaround times.



### Education

Make measurements quickly with eLearning and in-house, instructor-led training.



### Keysight Support

Get 24x7 access to service requests, case management help, and technical articles.



Keysight enables innovators to push the boundaries of engineering by quickly solving design, emulation, and test challenges to create the best product experiences. Start your innovation journey at www.keysight.com.

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